Environmental Cleanup at Navy Facilities: Adaptive Site Management

Committee on Environmental Remediation at Naval Facilities

Water Science and Technology Board

Division on Earth and Life Studies

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Preface

Under the auspices of the Water Science and Technology Board (WSTB), the National Research Council (NRC) established the Committee on Environmental Remediation at Naval Facilities in 1997 to study issues associated with the remediation of contaminated soil, sediment, and groundwater at Navy facilities. The committee was initially established to provide guidance on the following three main areas pertinent to characterization and remediation of Navy facilities:

1. **Risk-based methodology.** What are the strengths and weaknesses of risk-based methodologies for cleaning up contaminated sites, including (but not limited to) the Risk-Based Corrective Action Standard (RBCA) devised by the American Society of Testing and Materials (ASTM)?
2. **Innovative technologies.** What innovative technologies are appropriate to assist the cleanup efforts at Navy facilities?
3. **Long-term monitoring.** For Navy facilities that will not be able to meet regulatory standards for cleanup in the near future, what guidance can be given for establishing and maintaining long-term monitoring at such sites?

The project was supported by the U.S. Navy with the stipulation that the three study topics listed above would be funded incrementally.

The first report produced by the committee addressed risk-based methodologies (Task 1 above), providing a review of existing risk-based methodologies including ASTM's Risk-Based Corrective Action, a description of their strengths and weaknesses, and a set of recommendations on how the Navy should proceed. After publication of the first report in 1999, the NRC convened a workshop with some committee

members and about 30 Navy remedial project managers and others to better define a scope of work for future studies. In doing so, a proposal was developed that deviated somewhat in content from the second and third tasks above.

The goals of the Committee on Environmental Remediation at Naval Facilities Phase 2 were to address the following items (among others) related to the latter stages of site cleanup, including remedy selection, remedial operation, long-term monitoring, and site closeout.

Systems engineering approach. The study will define a decision-making framework that is embodied within a "systems engineering approach" to site cleanup.

Innovative technologies. The study will review the state of development of technologies for cleanup of groundwater, sediment, and soils, discussing the top two or three technologies that should be considered for the three to four greatest problems encountered by the Navy.

Changing the remedy over time. The study will consider how innovative technologies can be introduced after the remedy has been selected and how remedies can be adjusted over time.

Defining milestones for site closure. At many Navy sites, the continued operation of remedies beyond a certain level may not yield a marked improvement in site conditions. The study will consider when, and using what criteria, technologies should be "turned off."

These issues were identified by Navy managers as important to the growing number of sites where remedial goals have not been met despite continued operation of selected remedies. Most of these sites were characterized as those with recalcitrant contamination, including dense nonaqueous phase liquids, metals, and other persistent contaminants.

To address these issues, a new committee was convened that included six members from the Phase 1 effort along with nine new members. Their areas of expertise spanned from environmental engineering and hazardous waste management to systems analysis, sediment contamination, and public participation. The new committee convened its first meeting in July 2000 and met five additional times over the next two years. The resulting report promotes using the concept of *adaptive management* to move forward at those sites where progress in reaching

cleanup goals has halted. Although the concept of *adaptive site management* is particularly applicable to those sites that have reached the latter stages of site cleanup, it encompasses all stages of hazardous waste remediation, and it is consistent with current federal regulations (e.g., Superfund). I believe the committee's efforts provide useful guidance for some of the environmental restoration challenges of the Navy, which should also be relevant to a broader universe of sites and facilities. Adaptive site management is especially appropriate for remaining sites, which tend to be larger and more complex than those that have already been cleaned up.

The study benefited greatly from contributions from various individuals who made presentations at our meetings, including Stephen Eikenberry, Naval Facilities Engineering Service Center; Walt Kovalick, EPA Technology Innovation Office; Kevin Mould, EPA Federal Facilities Restoration and Reuse Office; Carol Bass and Ken Lovelace, EPA Superfund Office; Patty Lovera, Center for Health, Environment and Justice; Mike Maughon, Cliff Casey, and Steve Beverly, Southern Division NAVFAC; Frank Chapelle, U.S. Geological Survey; Rob Simcik, TetraTech NUS; Steve Rosansky, Battelle; Steve Tsangaris, CH2M Hill; Tom Sale, Colorado State University; Arun Gavaskar, Battelle; Deanna Spehn; Sabine Apitz and Victoria Kirtay, SSC San Diego; and Chuck Newell, Groundwater Services, Inc.

The committee was fortunate to have taken several field trips in conjunction with committee meetings. The following individuals are thanked for their participation in organizing and guiding these trips: Mike Maughon, Southern Division NAVFAC; Steve Rosansky, Battelle; Sam Ross, J. A. Jones; Ken Richter, Bart Chadwick, and Sabine Apitz, SSC San Diego; and Bill Collins, Southwest Division NAVFAC. The committee was ably assisted in these field trips and other administrative matters by Suzanne Benoit Albertsen, Naval Facilities Engineering Service Center.

The success of this report depended upon highly dedicated staff and the work of the committee members. I thank Laura Ehlers, the NRC study director for this project. Laura coordinated the committee meetings, gathered information, actively participated in the committee discussions, offered insightful comments and input, suggested alternative paths forward, and prepared copious minutes of the meetings. Laura worked with the committee members to maximize their contributions and written material, synthesized and edited the final report, and made the majority of revisions in response to reviewers comments. I appreciate the efforts

of Anike Johnson who took care of the many mailings and made local meeting arrangements. I thank Gene Parkin who assisted me as vice-chair. Gene's positive spirit and intellect are much appreciated. I would like to thank the committee members for providing a stimulating environment for addressing the study issues. I have enjoyed immensely the opportunity to work with such a talented and articulate group of professionals. I especially appreciate their willingness to spend time researching, writing, and revising their contributions.

More formally, the report has been reviewed by individuals chosen for their diverse perspectives and technical expertise, in accordance with procedures approved by the NRC's Report Review Committee. The purpose of this independent review is to provide candid and critical comments that will assist the authors and the NRC in making the published report as sound as possible and to ensure that the report meets institutional standards for objectivity, evidence, and responsiveness to the study charge. The reviews and draft manuscripts remain confidential to protect the integrity of the deliberative process. We thank the following individuals for their participation in the review of this report: W. Frank Bohlen, University of Connecticut; Teresa S. Bowers, Gradient Corporation; Mario Ierardi, Air Force Base Conversion Agency; Aaron A. Jennings, Case Western Reserve University; Michael C. Kavanaugh, Malcolm Pirnie, Inc.; Kai N. Lee, Williams College; Garrick E. Louis, University of Virginia; Stavros S. Papadopulos, S. S. Papadopulos Associates, Inc.; Peter M. Strauss, P. M. Strauss & Associates; and C. Herb Ward, Rice University.

Although the reviewers listed above have provided many constructive comments and suggestions, they were not asked to endorse the conclusions or recommendations, nor did they see the final draft of the report before its release. The review of this report was overseen by Richard A. Conway, Union Carbide Corporation (retired). Appointed by the NRC, he was responsible for making certain that an independent examination of this report was carried out in accordance with institutional procedures and that all review comments were carefully considered. Responsibility for the final content of this report rests entirely with the authoring committee and the NRC.

Edward J. Bouwer,
Chair

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